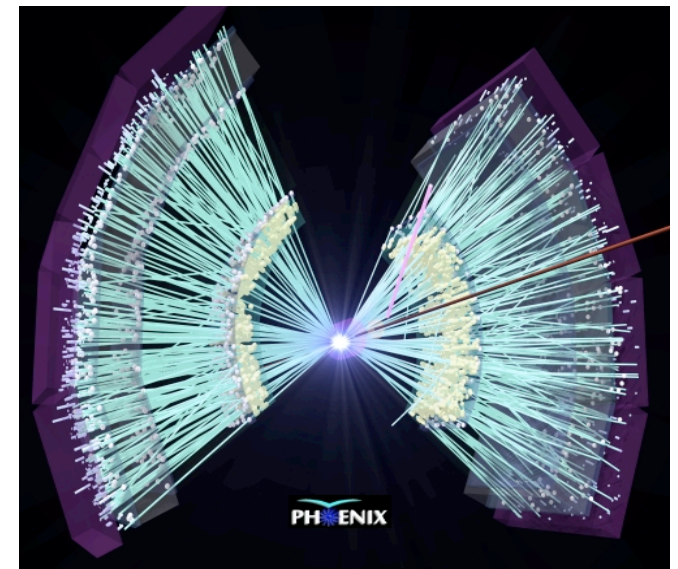
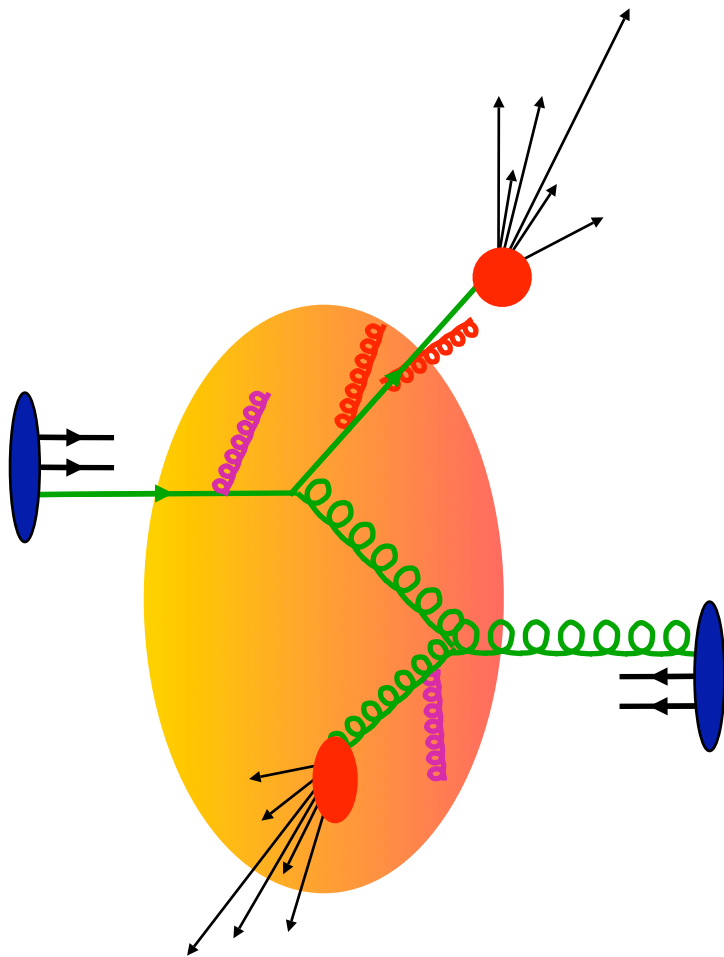


Identified Particle Jet Modifications in AuAu Collisions at PHENIX

Anne Sickles
June 20, 2005
Stony Brook

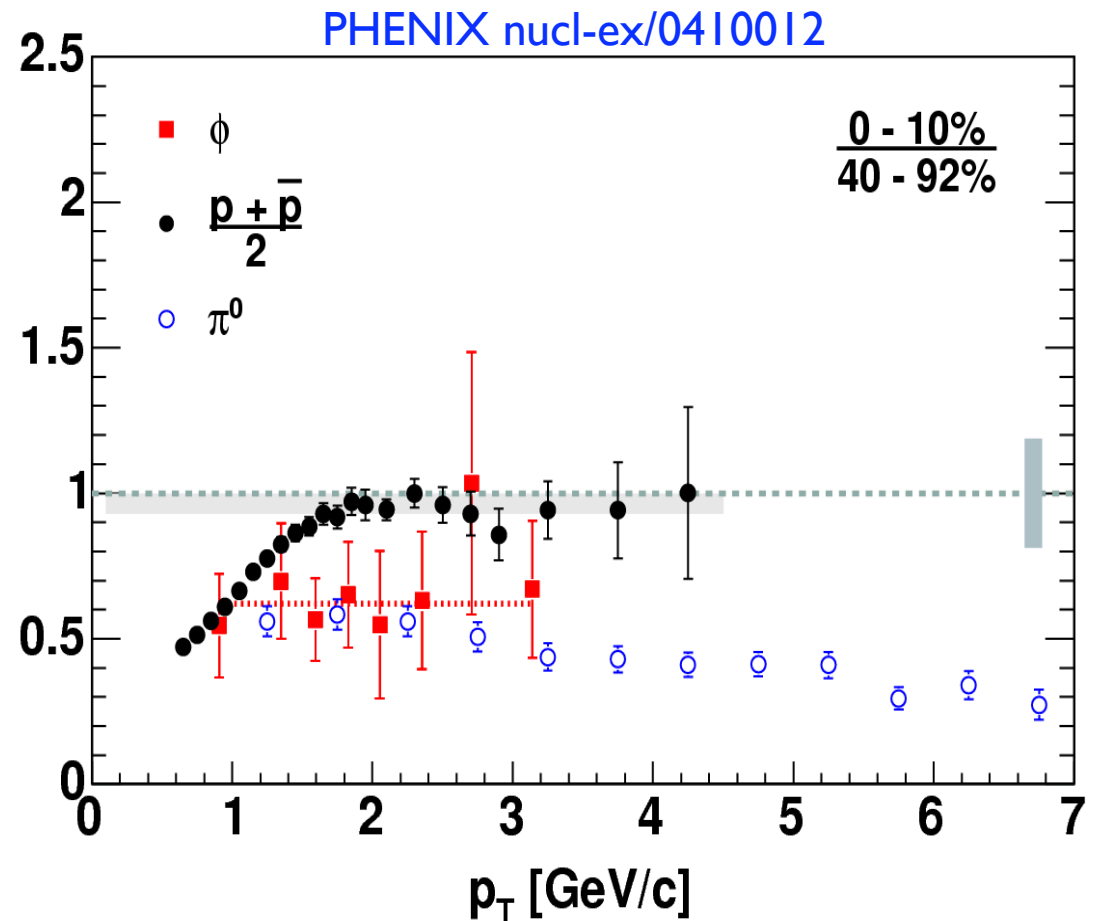
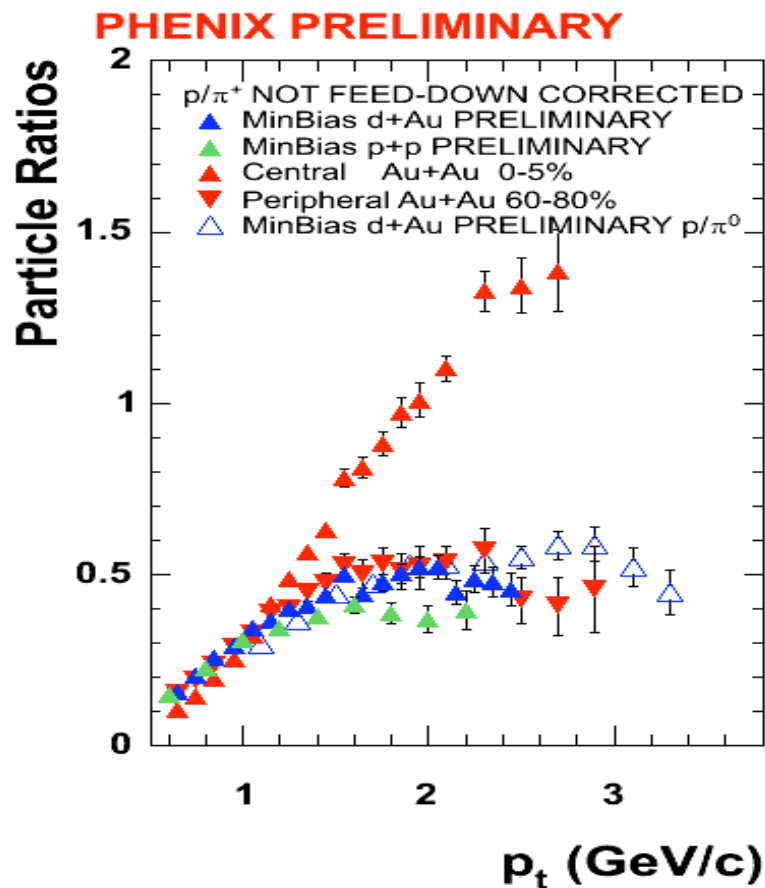


Probing the Medium with Jets



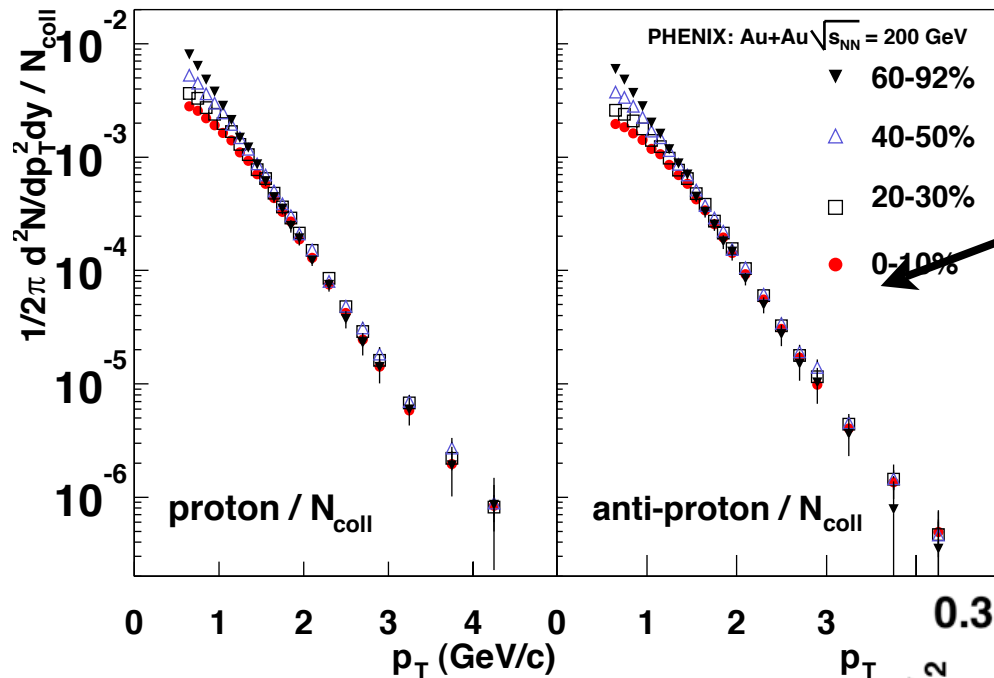
- jets are produced early and probe entire lifetime of medium
- jets are a calibrated probe
- what happens to the radiated energy?
- is the hadronization process affected by the medium?

Baryons are Weird



Particle identification is crucial for understanding particle production at intermediate p_T

Where do the Extra Baryons Come From?

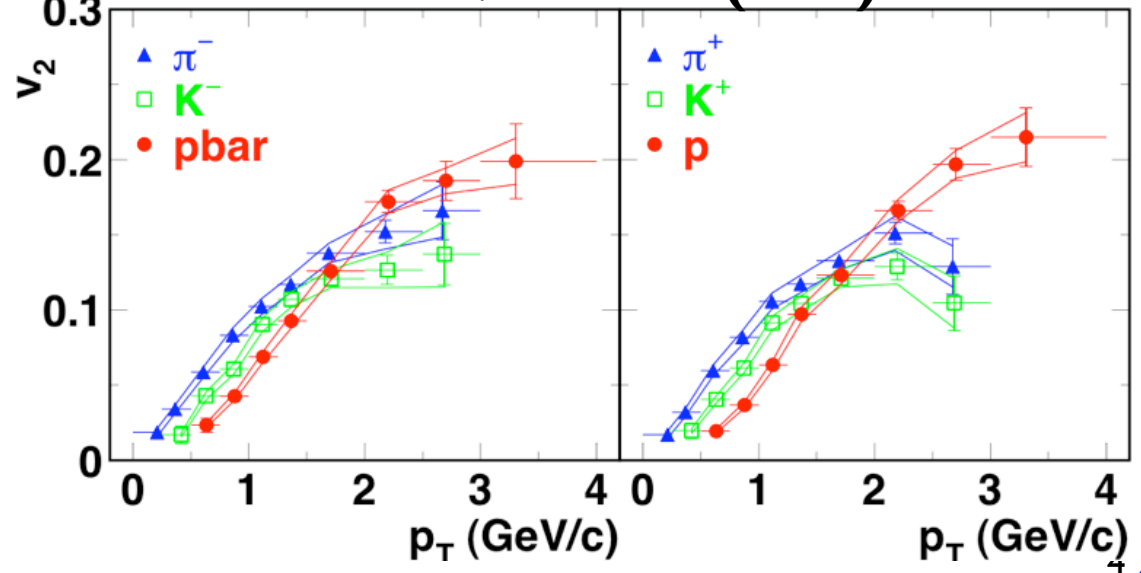


PHENIX PRL 91 172301 (2003)

Large baryon v_2 --
soft source
boosted to
intermediate p_T ?

N_{coll} scaling
jets source?

PHENIX PRL 91 182301 (2003)

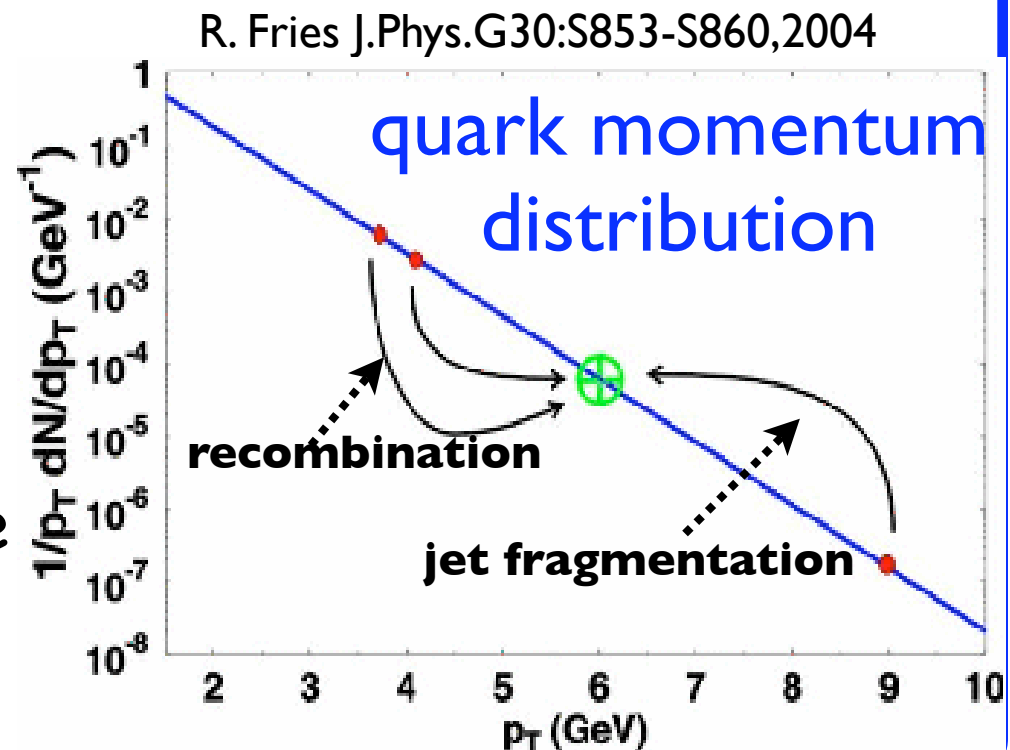


Recombination

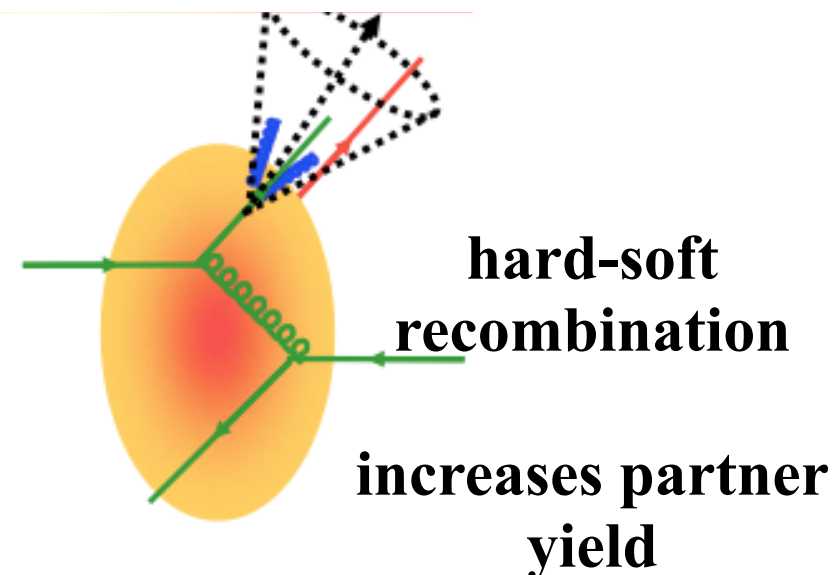
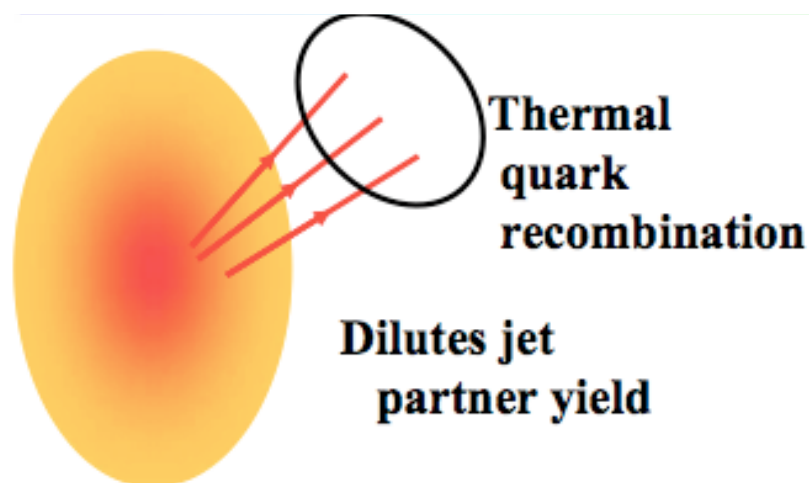
Greco, Ko & Levai
Fries et al.
Hwa & Yang

- quarks close together in phase space recombine to form observed hadrons
- recombining quarks come from either jet or thermal source, but all models predict a significant number of intermediate p_T particles come from non-jet sources
- predicted to dominate where quark p_T spectrum is exponential

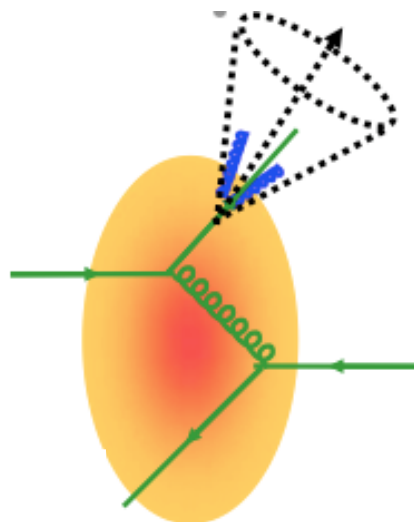
provides simple, natural explanation for baryon and meson differences



Varieties of Recombination



**recombination
could be the way
of understanding
how the medium
modifies
fragmentation**

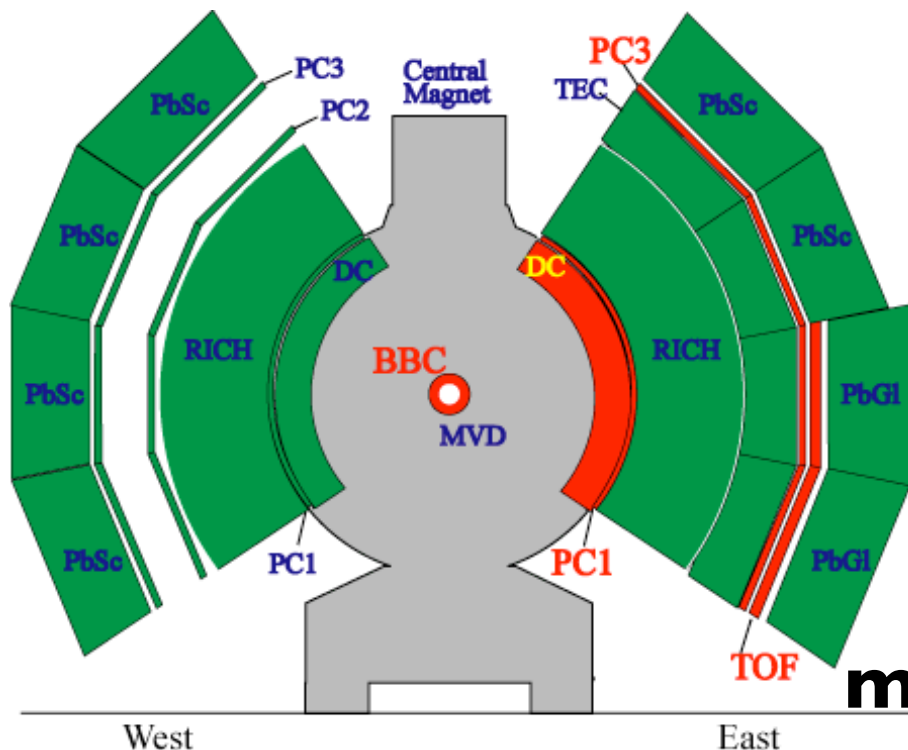


**recombination from
correlated source**

**impact on yield depends
on relative importance
of fragmentation & recombination**

Two Particle Jet Correlations

**find jets
statistically**



trigger
at high p_T

"near side" $\Delta\Phi < 90^\circ$
jet partner

"away side" $\Delta\Phi > 90^\circ$
opposing jet
partner

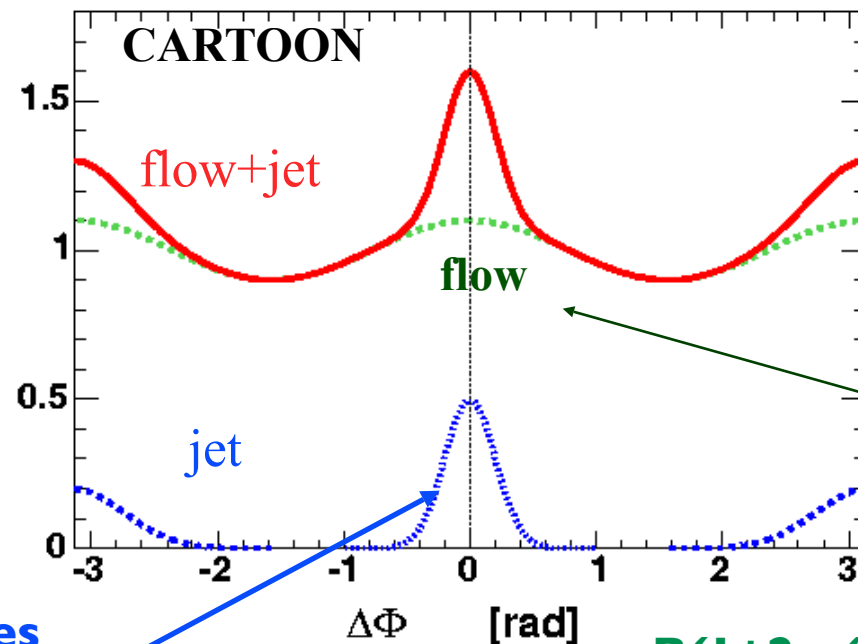
method finds biased high z jets

Subtracting the Underlying Event

includes **ALL** triggers
(even those with no
associated particles in
the event)

**assumption: no
correlation between
flow & jets**

$$\frac{1}{N_{\text{trig}}} \frac{dN}{d\Delta\phi}$$



**associated particles
from underlying event**

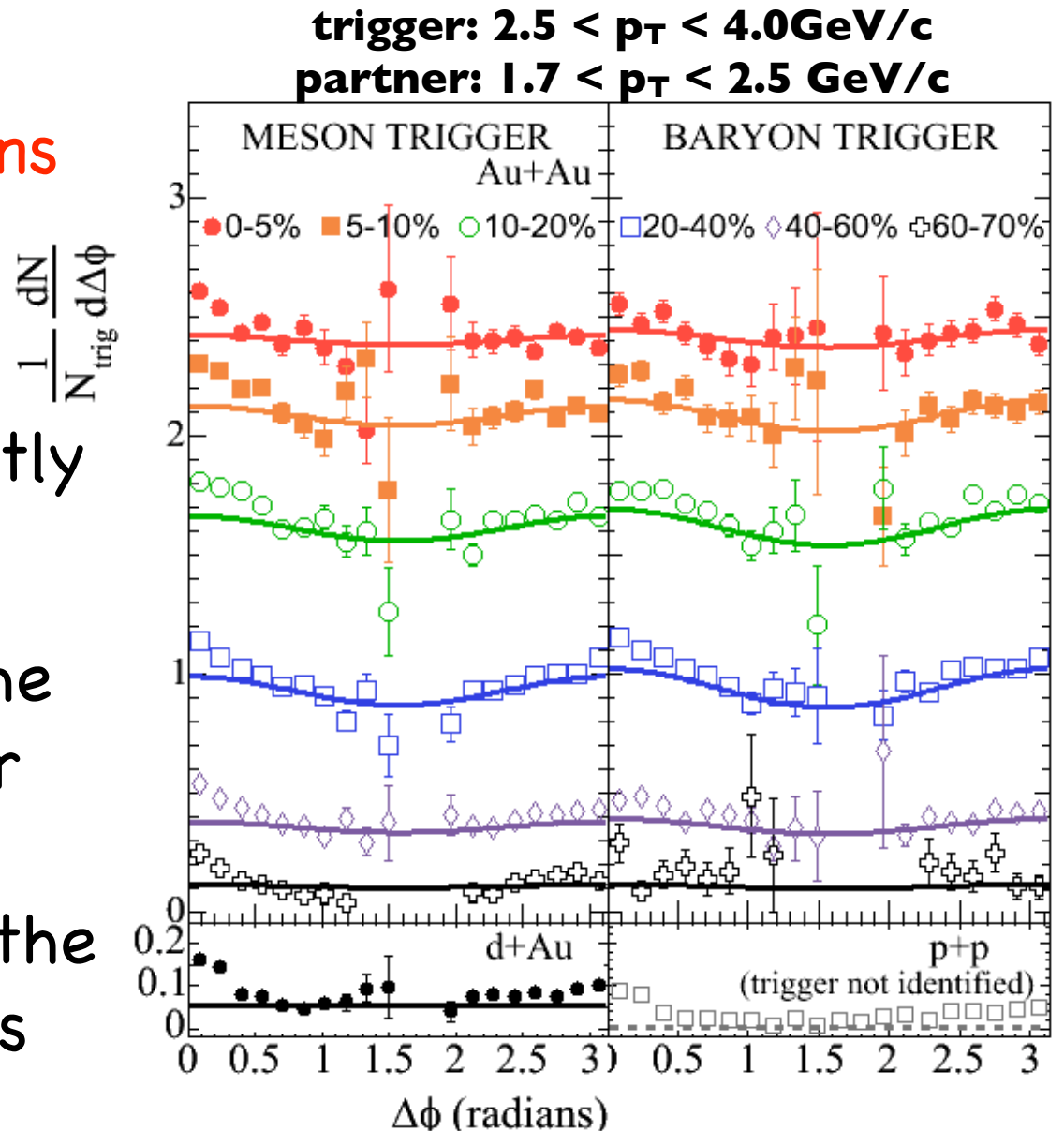
**associated particles
with
non-flow angular
correlations → jets!**

$$B(1 + 2v_2(p_T^{\text{trig}})v_2(p_T^{\text{assoc}})\cos(2\Delta\phi))$$

**v_2 values measured separately
PHENIX PRL 91 (2003) 182301**

Background Normalization

- no fitting or assumptions about signal shape
- combinatoric level determined independently from mixed events
- mixed events have the same average trigger and partner rates as real events, but not the additional signal pairs

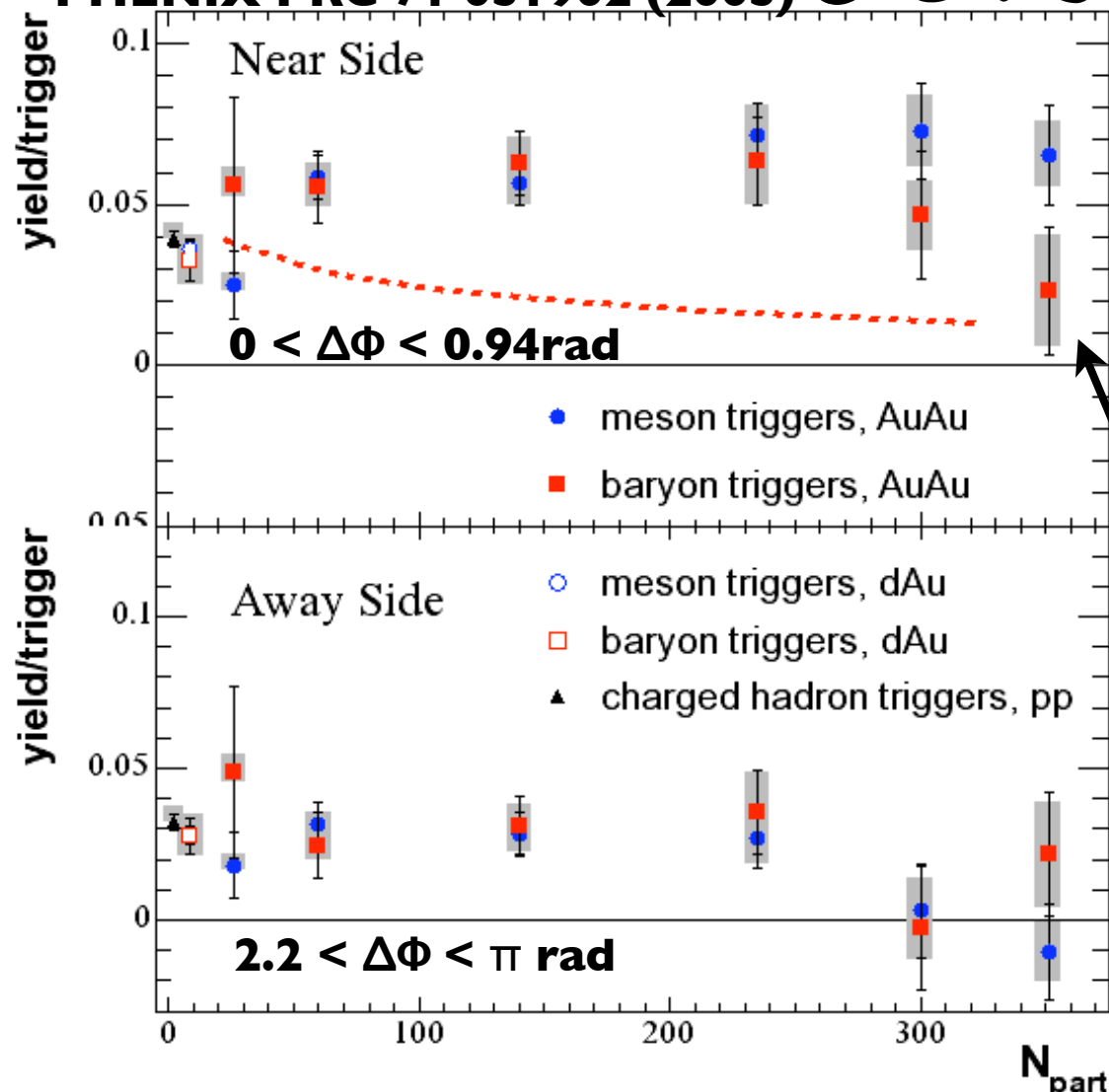


Multiplicity Correlations

- real correlations due to higher multiplicity in more central edge of the centrality bin → more pairs
 - will exist in any finite size centrality bin
- correction determined via a Glauber model based MC
 - create pairs whose only correlation is centrality and compare to combinatoric rates
- depends on pT, particle species, and centrality
 - ~0.2% of background level in central AuAu collisions
 - ~25% in peripheral AuAu collisions

Are the Baryons from Jets?

PHENIX PRC 71 051902 (2005)

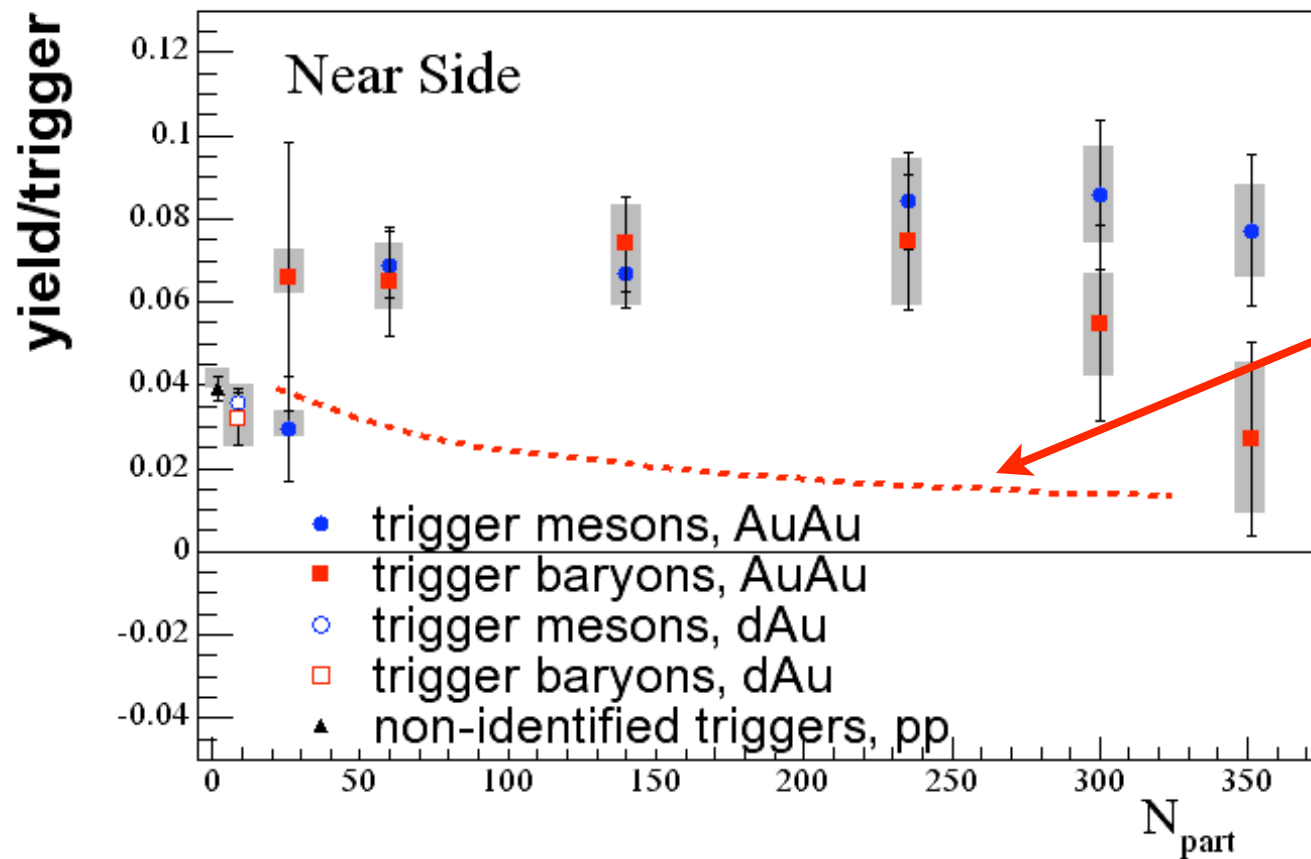


- integrate partners/trigger above combinatoric level for both near and far sides
- no significant difference between trigger baryons and mesons → baryons are from jets
- perhaps jet source is diluted in most central for trigger baryons
- away side yields confirm jet source for baryons

trigger: $2.5 < p_T < 4.0 \text{ GeV}/c$
partner: $1.7 < p_T < 2.5 \text{ GeV}/c$

Jets are strongly modified in AuAu collisions compared to pp

Thermal Recombination?



**upper limit on
thermal baryon
source from
measured
antiproton/pion
ratio**

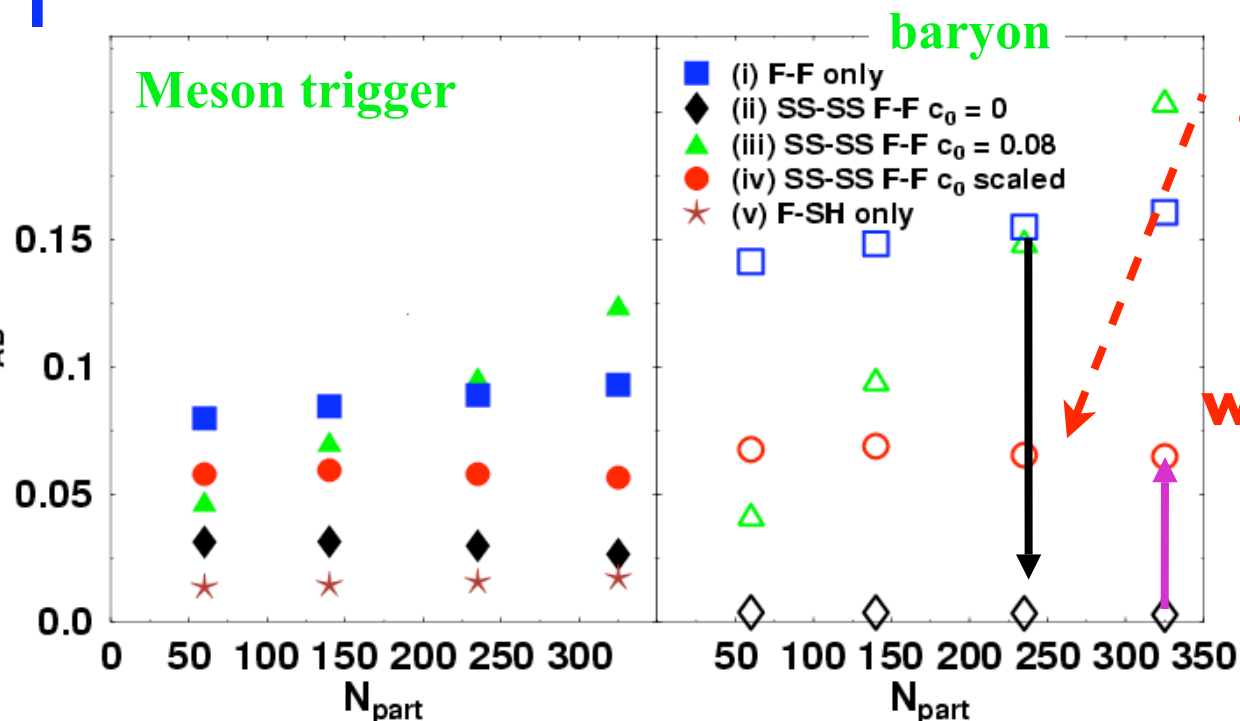
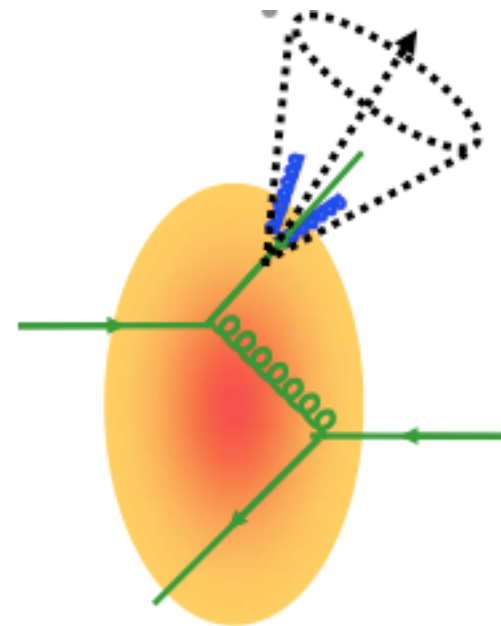
**data inconsistent with centrality dependence
and absolute value of thermal source limit
→ excess baryons must come from jets**

What's Going On?

Recombination from a
correlated source

“wake” effect?

→ correlations amplified
according to valence quark
number



agrees with present data

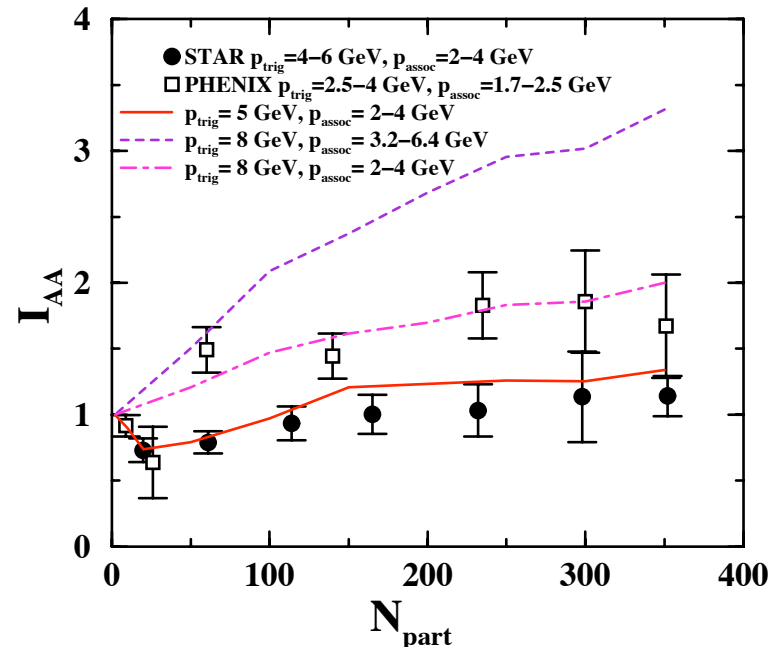
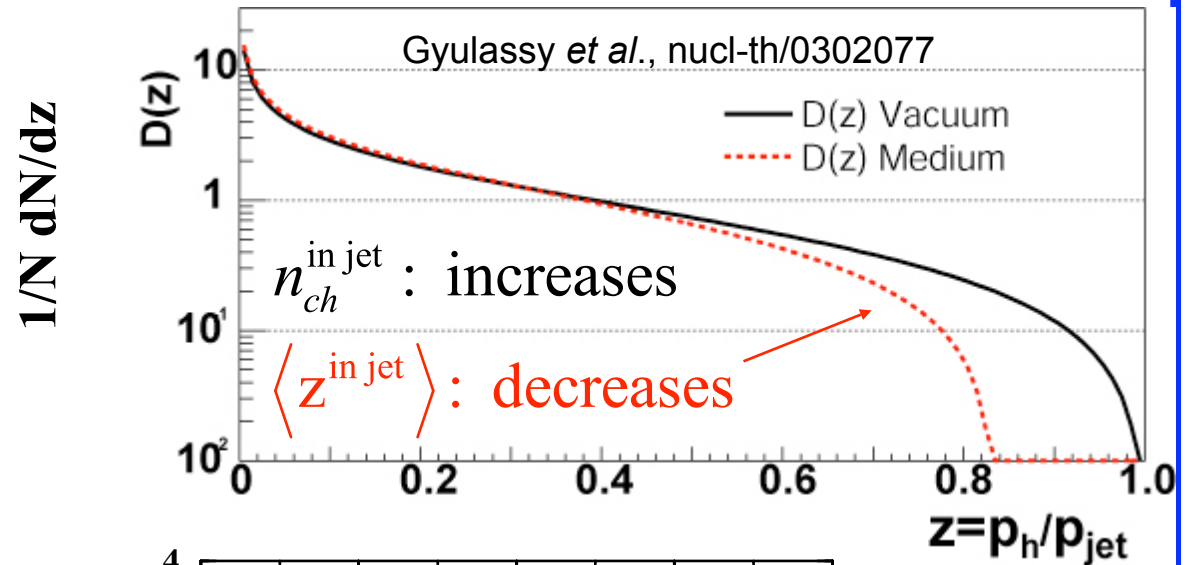
**correlations with both
particles identified
will provide a stronger test**

**trigger: $2.5 < p_T < 4.0 \text{ GeV}/c$
partner: $1.7 < p_T < 2.5 \text{ GeV}/c$**

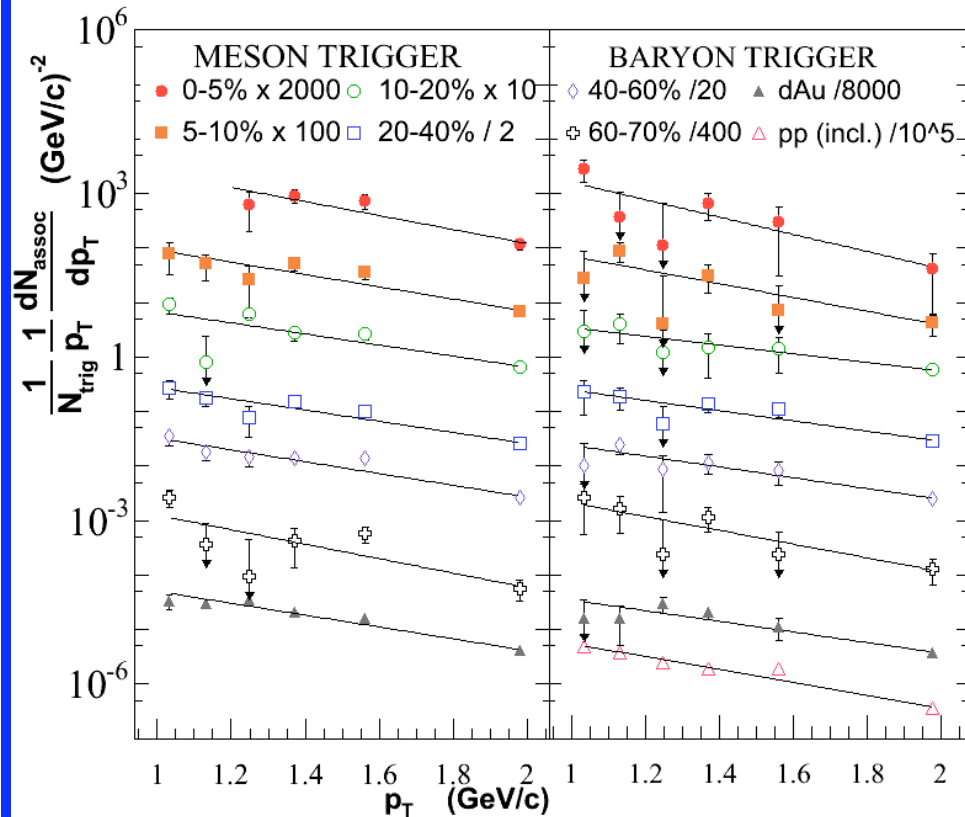
Fries, Bass & Mueller
PRL 94 (2005) 122301

Energy Loss

- AuAu jets are strongly modified; don't come purely from the surface
- trigger particle must lose energy, which could increase the partner yield relative to pp



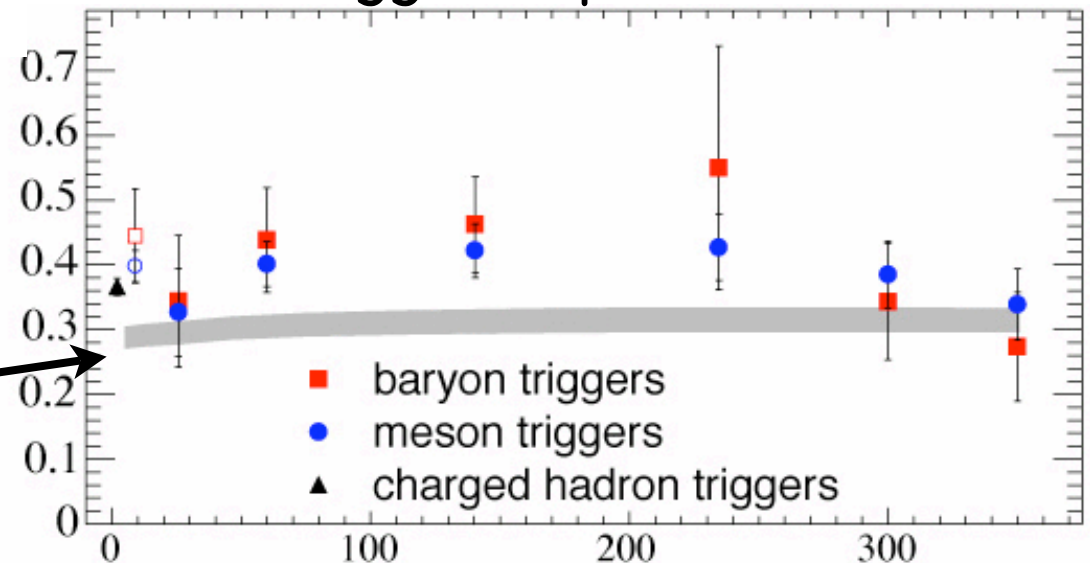
Near Side Partner Spectra



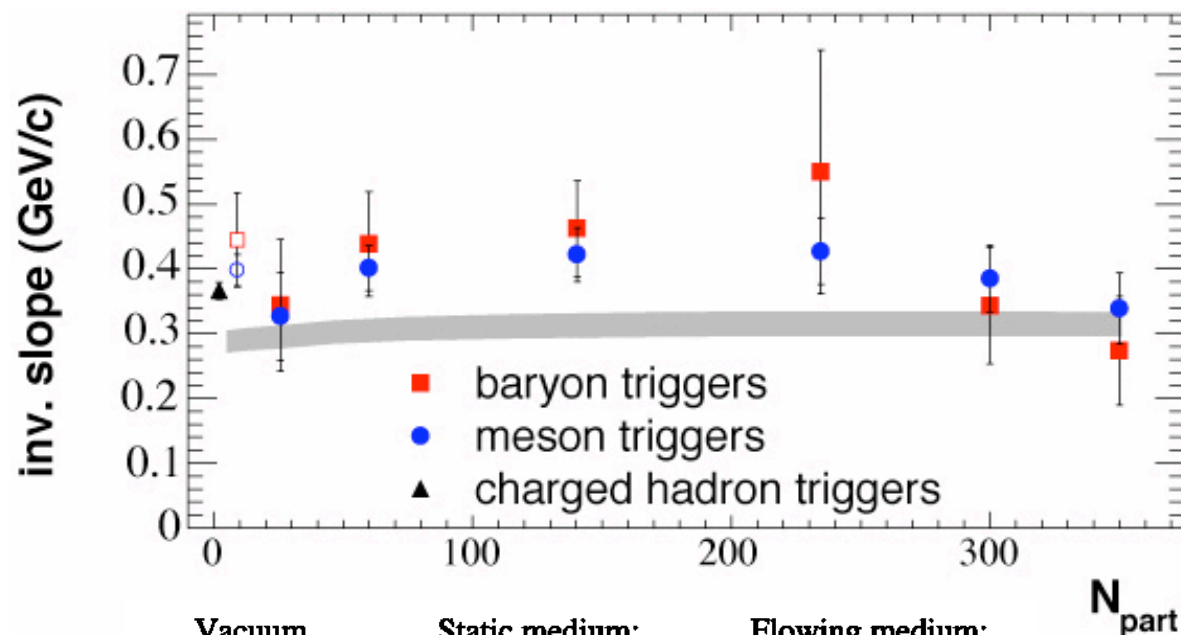
- corrected to full jet yield according to symmetric fragmentation in $\Delta\Phi$ & $\Delta\eta$
- partner spectrum flatter, as expected from jet source
- partner spectrum soften in more central collisions
- no trigger dependence

inclusive particle slope

inv. slope (GeV/c)

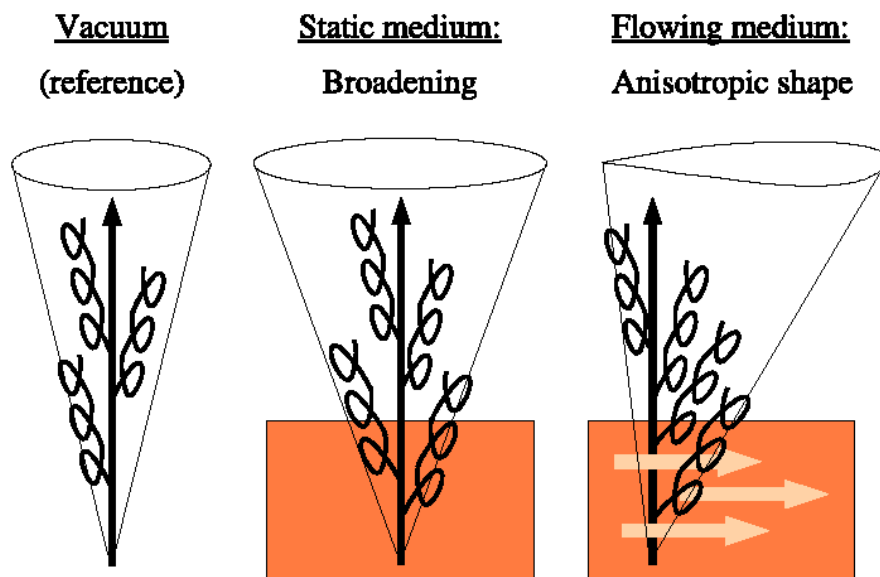


Jet Broadening in η ?



- a wider jet cone in $\Delta\eta$ would further soften central AuAu partners

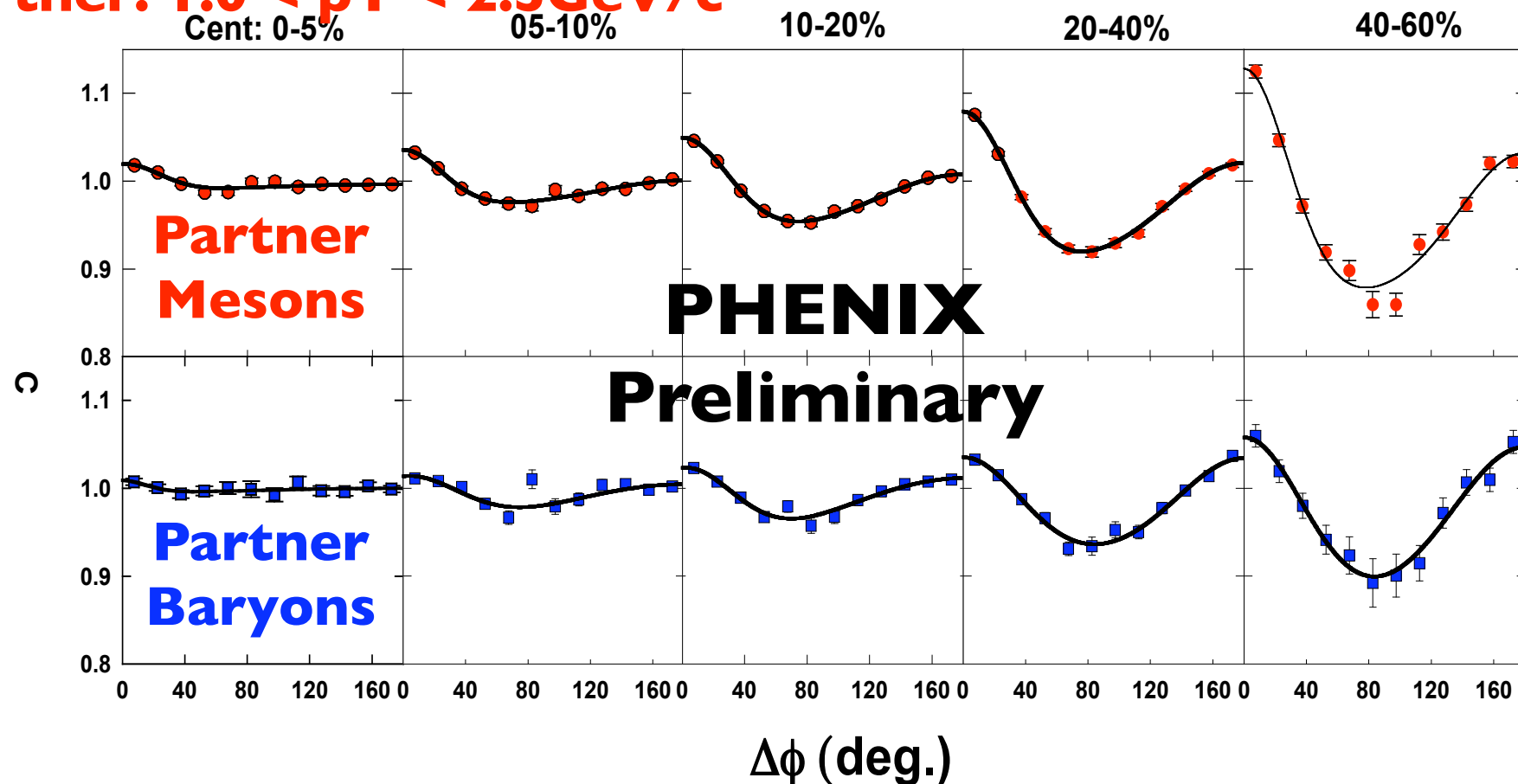
- what would it mean for the jet partners be softer than inclusive hadrons?



Identified Partners

trigger: $2.5 < p_T < 4.0 \text{ GeV}/c$

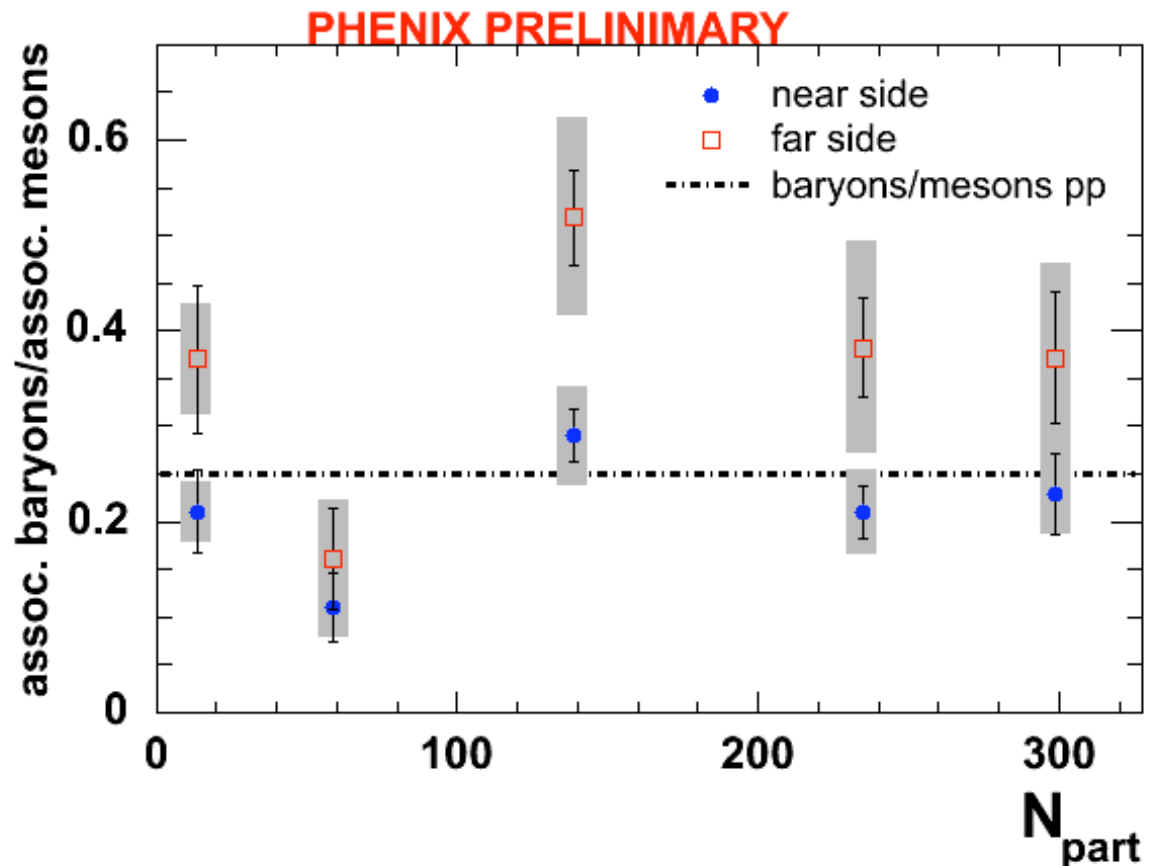
partner: $1.0 < p_T < 2.5 \text{ GeV}/c$



partner baryon distributions have less asymmetry

Jet Partner Ratios

- near side baryon to meson consistent with pp baryon to meson ratio
- far side has higher ratio--medium modified jet fragmentation?
- no significant centrality dependence



trigger: $2.5 < p_T < 4.0 \text{ GeV}/c$
partner: $1.0 < p_T < 2.5 \text{ GeV}/c$

Conclusions

- baryons at intermediate p_T are from jets
 - possible dilution from non-jet source in the most central collisions
- jet fragmentation is modified by the medium
 - richer in baryons
 - more lower p_T partners
 - strong modification even on near side--surface emission?

What's Next?

- higher statistics measurements
 - is the dilution of the baryon triggered yields real?
- Identify both particles
 - stronger test of recombination scenarios
- higher and lower pT identified triggers
 - changes in the yields where the p/π ratio is changing